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LIVESTOCK RESEARCH

Soil amendments that may help reduce the loss of P from soils testing high

Agriculture, especially where concentrated animal feeding operations dominate, is thought to be a significant contributor to a non-point source of P pollution in surface waters. This problem is front page news in Arkansas because poultry production in northwest Arkansas is thought to be a contributor to P in scenic rivers and streams in eastern Oklahoma.

Areas with concentrated animal feeding operations tend to have high soil test levels for P and thus are more likely to contribute to higher losses of P from agricultural land to surface water. The reason for this association is as follows. Most livestock species, including cattle, pigs, and chickens, utilize plant sources of P poorly. Therefore, feeds have relatively high amounts of P and a lot of this P passes through the animal ending up in the manure or other animal waste. Animal waste tends to have a N to P ratio of 3 to 1, whereas plants need a N to P ratio of 10 to 1. Thus, animal waste, on average, has three times more P than N relative to the plant needs. P in soils is relatively immobile, especially as compared to N. This combination of high amounts and retention leads to soil test values for P to increase dramatically where animal waste from concentrated feeding operations are applied to a limited land base.

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In 1998, an ARS scientist from the laboratory at Auburn AL , Dr. Jim Edwards, approached Dr. Aiken, at this Center, to participate in a series of studies to test the feasibility of different means to accelerate the reduction of a soil testing high in P. The site for these experiments was a farm near Kurten TX. Over the last 40 years this farm was first a diary and then a 500,000 bird egg laying operation. The soil test values for P on some of the fields on this farm exceed 2,000 pounds of P per acre. Dr. Edwards did a wonderful job of assembling an excellent team of ARS scientists from at least 3 laboratories to study solutions to the problem of high soil test values for P on this farm. Unfortunately, Dr. Edwards was diagnosed with cancer soon after assembling the scientific team and died before seeing much progress from the experiments he initiated. My involvement in these experiments occurred after Jim's diagnosis and was inspired by his dedication to research and agriculture.

One of the experiments at Kurten TX is examining the effectiveness of various soil amendments to reduce soil test levels for P. Three different types of soil amendments are being tested. They are: gypsum, alum, and waste paper product. Gypsum (calcium sulfate) can aid aggregate soil particles, thus decreasing the loss of sediment and its associated P when runoff occurs. In addition, gypsum is a relatively soluble form of Ca and the Ca from gypsum can react with the readily soluble soil P to create calcium phosphate, thus reducing the soluble P in runoff. The ARS laboratory in Fayetteville AR has worked extensively on the use of alum to reduce the risk of P moving off lands on which poultry litter has been applied. Alum is an excellent source of Aluminum (Al) and Al reacts with soluble P to form Al phosphate. Al phosphate is a very insoluble form of P. A soil amendment made from old phone books or mass mailings that can not be delivered by the U.S. Postal Service is a way to use these resources rather than being placed in a landfill. The paper products mentioned above are high in Al, thus a way to proper soil

amendment and would serve as an alternative to alum in supplying Al to complex with soil P. In addition, the organic matter in the waste paper amendment would serve to aggregate soil particles in a manner similar to that induced by gypsum. In theory, the waste paper product would have modes of action similar to both gypsum and alum. At Kurten TX, small plots were amended annually in the spring for 3 years (1999-2001) with gypsum, alum, or a soil amendment made from blending waste paper and N to produce a C to N ratio of 30 to 1. Soils were sampled four months later in 1999 to 2001 and various soil tests for P were performed. Soil test values for plant available P were not affected by the soil amendment treatments over the course of the study to date. However, water soluble P levels decreased dramatically when gypsum was applied. P detected by this test is of great concern to environmentalists. Aquatic ecosystems tend to be deficient in water soluble P and the addition of water soluble P can affect aquatic ecosystems rapidly and in a drastic fashion. Therefore, a decrease in water soluble soil P by gypsum was a highly significant result. It was unexpected that gypsum would have such an effect at this site because the soils were also high in Ca. The Ca present in the soils at the Kurten farm must be in such a form making a response to gypsum possible.

It was also somewhat surprising that neither alum nor the waste paper amendment was effective in reducing water soluble soil P. Initial characterization of the soil prior to adding the amendments indicate low levels of Al phosphate. Therefore, these soils should have a great potential to form Al phosphate. The lack of an effect of alum and the waste paper amendment led to a series of laboratory experiments with soils from the Kurten farm. The results from the laboratory indicate the higher the soil tests values for P and Ca in this soil the more unstable Al phosphates were. These results also provide a basis to explain why alum and the waste paper amendments were ineffective under field situation. A more general conclusion from this research is that relatively complex soil chemical properties modulate the effectiveness of gypsum and alum in reducing the soil water soluble P.

The last soil amendments in this experiment were applied in 2001. Soils will be monitored over the next few years to assess the long term effects of these treatments on soil test levels for P. Also on this farm, Dr. Aiken is investigating forage systems to optimize P removal. Updates to follow in the future.

David K. Brauer

Success is to be measured not so much by the position that one has reached in life as by the obstacles that one has overcome while trying to succeed.

Booker T. Washington

WHOLE ANIMAL COMPOSTING OF CATTLE

Cattle losses due to weather, natural causes, etc. occur each year. Rendering services currently pick up most carcasses from the farm. However, with the concern of Bovine Spongiform Encephalopathy (BSE), commonly known as Mad Cow Disease, feeding animal-derived protein to cattle is prohibited. This has decreased the need for animal rendering and increased the cost of removing carcasses from the farm. The abundance of stockpiled manure and old feedstuffs on many farm makes whole animal composting a feasible alternative for carcass disposal.

PROPER COMPOSTING PROCEDURES

Composting is the natural decomposition of organic materials by microorganisms that require oxygen (aerobic). There are several factors that affect the success of the composting process:

carbon and nitrogen ratios (C:N ratio)
moisture content
particle size
oxygen concentrations
temperature

The proper mix of composting materials requires both carbon and nitrogen at a 25:1 to 30:1 ratio. With the proper C:N ratio, odor will be kept to a minimum. It usually is necessary to add plant materials, such as old feedstuffs or straw, to have the proper carbon levels in the manure compost mix. The compost mixture's moisture content should be 50 to 60 percent. If the mixture feels moist but no water drips from a handful when squeezed, the moisture level is adequate. To ensure aeration of the compost pile, particle size of composting materials should range between 1/8 to1/2 inches in diameter. Aeration by turning also introduces air into the compost pile. However, turning of a compost piles requires either expensive equipment and/or is time consuming. Alternatively, properly constructed static piles may provide enough aeration to compost whole animals without needing to be turned. Optimal composting temperatures range from 110 to 150 F. Compost piles need a layer of inactive material (approximately 1 foot thick) to insulate the pile and maintain high temperatures. Temperatures above 131 F for 72 hours are necessary to destroy human pathogens and most plant pathogens. Weed seeds usually are destroyed at 145 F. Extremely high temperatures are detrimental to composting with microbial activity declining at temperatures greater than 160 F.

How to compost whole cow carcasses

An animal carcass generally has a low C:N ratio (high nitrogen levels with relatively low carbon), high moisture content, and virtually no air. Consequently, compost materials must include high C:N ratios, moderate moisture, and satisfactory porosity for aeration. Proper composting consists of layering the carcasses with composting materials in a static pile until the soft carcass tissue has decomposed fully.

Site selection is important to the overall success of composting. The composting pile should be located to allow easy access, minimal travel, convenient handling of manure and straw/old feedstuffs, a proper distance from live cattle, and not near neighbors and water sources or streams. Good drainage of the compost pile also is necessary to prevent water from pooling. Excessive drainage should be avoided to prevent nutrients from running off into nearby streams, etc. Ideal slope should be 1 to 3 percent for proper drainage. The composting pad should be firm but does not need to be paved. Sand or gravel at depth of 6 inches is desirable when current soil conditions are not acceptable.

Compost pile construction should begin by placing on the ground a plastic liner (6 millimeter) 10 to 12 feet wide and the length of the pile or windrow. Next, place a base of compost materials (manure and straw/old feedstuffs) on top of the plastic liner approximately 1 to 1.5 feet deep. A 50:50 ratio of manure and the carbon source generally is recommended. This ratio will vary with the chemical and biological characteristics of the manure and carbon source. Laboratory analyses of raw composting materials are necessary to get the optimal compost mixture. The carcass should then be placed on top of the base. To decrease composting time and to allow the carcass to be laid flat, the animal's body cavity should be opened; however, caution should be used due to possible disease transmission. Water can be added. Finally, the carcass should be covered with 8 to 12 inches of the compost mixture. Carcasses need to remain fully covered during the composting process.

Large square hay bales can be placed around the pile's perimeter to protect from pests. Furthermore, if there is runoff from the compost pile, the hay will act as an absorbent.

In a properly managed compost pile, the core temperature of the pile should reach 145 F in 3 to 4 days. After approximately 2 weeks, volume of the pile will reduce to one-half its original size. Decomposition of a cow carcass generally takes 6 to 8 months with a few small bones remaining. The remaining bones will be soft and shatter easily when passed through a manure spreader during land application.

Cattle composting experiments.

While working as a dairy specialist in NM, we conducted an experiment to determine feasibility of whole animal composting in a static pile. Twelve (12) cow carcasses were used to initiate whole animal composting on a large (approximately 3,000 lactating cows), southern New Mexico dairy operation. Compost pile construction was established as described above. Dimensions of the final pile were 14 to 15 feet wide and 6 feet high. Carcasses were uncovered at 2 and 4 months to determine time needed to decompose cows. At 2 months, carcasses were 60 to 65 percent decomposed. The bones were clean, and the flesh was 90 percent decomposed. After 4 months, carcasses were somewhat difficult to find with only several small bones (7 to 10 bones/carcass) remaining. The C:N ratio was 12:1 prior to composting and 11:1 after composting. Such results demonstrate the whole animal composting in a static pile may be an alternative means of disposal of dead cows.

Cost of whole animal composting, which includes a synthetic liner, is estimated to be approximately $4 per carcass. Carcass compost is an excellent source of fertilizer nutrients. However, the compost generated from decomposed animal carcasses should not be given or sold as compost for off-farm use.

Currently, we have initiated a whole animal composting experiment here at the Center in Booneville, AR. In October 2002, a compost pile was constructed on a 20 foot x 40-foot concrete pad. Four bovine carcasses were placed in the pile. A data logger that records the temperature every 8 hours was placed 2 feet into the pile. The pile was then covered with a synthetic liner. Compost piles must have oxygen to properly compost and decompose the carcass. Usually this requires the pile to be turned with a front-end loader or windrow turner. To aerate our compost pile, we drilled holes in plastic pipe (4" PVC) and placed them at the based of the pile. We plan to compare composting times and compost material characteristics between chicken litter and a cow manure:hay mixture. Updates to follow.

Michael L. Looper

Effect of Breed-type on Performance and Carcass Traits of Intensively Managed Hair Sheep

There is a desire to incorporate an easy-care animal into small to mid-size sustainable production systems. Hair sheep possess desirable attributes as they shed their hair/wool coat and may be more tolerant to intestinal parasites than most wool breeds; however,

growth rate and mature size of hair sheep is less than that of traditional breeds of wool sheep.

The Dorper is a relatively new breed of hair/wool shedding sheep in the U.S., introduced in 1995. Carcass characteristics and tenderness of the meat of Dorper crossbred lambs have been favorable compared with wool breeds in studies conducted in Idaho and Wyoming. St. Croix, a smaller framed hair sheep originally from the Virgin Islands, have found a place in ethnic markets, but are discriminated against in traditional lamb markets. Dorper lambs, on the other hand, are larger and may be more suited for marketing along with typical wool breeds of sheep; however, very little is known about the growth rate and carcass characteristics of this hair sheep breed under U. S. production systems. Therefore, a study was conducted to evaluate growth performance and carcass characteristics of intensively managed purebred and crossbred hair sheep, and determine the value of the Dorper breed as a terminal sire on St. Croix and St. Croix-cross dams. Lambs were grown at the ARS station in Booneville and processed at the University of Arkansas under the direction of Dr. Jason Apple.

From birth to weaning, daily gains were greater for Dorper crossbred and Katahdin lambs than St. Croix and St Croix crossbred lambs. After weaning, lambs were fed a diet formulated for medium growth potential. From weaning to harvest, gains were greater for Dorper crossbred, followed by St. Croix type and Katahdin lambs. Carcass weights were heavier for Dorper crossbred lambs than all other breeds and St. Croix carcasses were leanest. The loineye area was largest for Dorper crossbred carcasses and smallest for St. Croix type carcasses. Conformation scores and quality grades were greater for Dorper crossbred than St. Croix type carcasses. Tenderness was greater for Dorper crossbred and St. Croix type carcasses than Katahdin (but in a subsequent study tenderness was similar among these breeds).

Although the rate of growth from birth to weaning was similar for Dorper-sired and Katahdin lambs, results of the present study demonstrate that gain was greater for Dorper-sired compared to St. Croix-sired and Katahdin lambs from weaning to harvest. The use of Dorper rams improved carcass weight and muscling when used on St. Croix and Romanov × St. Croix ewes, and appear to be excellent hair sheep sires to produce carcasses that would appeal to the traditional lamb markets in the U. S. However, St. Croix-sired lambs, albeit trimmer, may continue to be discriminated against in traditional markets because of their lighter-weight, lighter-muscled, low quality carcasses.

This published manuscript can be viewed at *Meat Science* 2003; 63:309-315 or request a reprint from Dr. Burke. Collaborators of this study include: J.K. Apple, W.J. Roberts, C.B. Boger, and E.D. Kegley.

Relative resistance of Dorper crossbred ewes to gastrointestinal nematode infection compared with St. Croix and Katahdin ewes in the southeastern United States

Hair sheep fit well into small to mid-size sustainable production systems in the southeastern United States because they do not require shearing, present a means of forage management, may be tolerant to the harsh summer climate, and may be more resistant to internal parasite infection than most wool breeds.

Resistance to parasite infection has been documented in St. Croix and Katahdin sheep. The Dorper breed has not been evaluated for parasite resistance under southeastern U.S. conditions compared with other hair breeds. Therefore, a study was conducted to evaluate Dorper crossbred ewes, compared with St. Croix, Katahdin, and Hampshire (susceptible to parasites) ewes for indications of resistance to parasite infection under natural grazing conditions and under an experimental infection with *Haemonchus contortus*. *H. contortus*, or barber pole worm, is the parasite that leads to anemia, sometimes death of the animal, and economic loss for small ruminant producers.

The Dorper ewes appeared to be nearly as resistant to infection as the Katahdin and St. Croix breeds and more resistant than the Hampshire ewes when the challenge was low to moderate. Under southeastern conditions in the current study, Dorper crossbred ewes maintained good or excellent body condition and demonstrated relative resistance to natural or experimental infection.

Efforts are underway to find sustainable means of controlling internal parasites. Safe drenching techniques will be presented at Sheep and Goat Day 2003 to be held at the South Logan County Fairground on September 20, 2003. A workshop will be included at this field day as part of a SARE grant funded to Fort Valley State University that addresses these problems. It has become clear that producers will need to find management strategies to live with or control these parasites rather than eradicate them. Genetic resistance is a potential strategy (individuals among a flock or breed resistance) as well as co-grazing with cattle. Attend the field day to learn more.

For complete viewing of this publication see *Veterinary Parasitology* 2002; 109:265-275 or request a reprint from Dr. Burke. Dr. J.E. Miller is a collaborator in this on-going research project.

We didn't inherit the Earth from our parents. We're borrowing it from our children. Chief Seattle

Dale Bumpers Small Farms Research Center is a partnership among three institutions:

ARS- conducts research related to livestock production and agroforestry; ARS staff can be reached at 479-675-3834.
Visit our web site at http://www.booneville.ars.usda.gov.

PMC/NRCS- evaluation of vegetation and vegetation technology to retain soil and its productive capability; NRCS staff can be reached at 479-675-5182.
Visit our web site at http://Plant-Materials.nrcs.usda.gov/arpmc/index.html

Division of Agriculture / University of Arkansas- dissemination of agricultural information. Extension Specialist, Billy Moore, can be reached at 479-675-5585.
Visit our web site at http://www.uaex.edu.

ARS scientists at DBSFRC and their primary research focus:

David Brauer- Agronomist/Research Leader investigating both agroforestry and livestock production

Glen Aiken- Agronomist investigating production practices for stockers

Adrian Ares- Forester working on tree growth and physiology in agroforestry systems

David Burner- Agronomist investigating crop production in agroforestry systems

Joan Burke- Animal Scientist investigating reproductive performance in cattle and production practices for hair sheep

Michael Looper - Animal Scientist investigating beef cattle production

Dan Pote- Soil Scientist investigating the effects of management practices on sediment and nutrient retention in agroforestry and livestock production systems.

Organizations promoting agriculture in the Ozark Region

The information below is not an exhaustive list of organizations trying to help farmers and ranchers in the Ozarks. If your organization is interested in being included, please contact David Brauer.

Poultry Production and Product Safety Research Unit (PPPSRU)/ARS/USDA/Center of Excellence for Poultry Science is located on the campus of the University of Arkansas in Fayetteville. PPSRU conducts research to solve problems related to: 1) diseases and physiological disorders that are of economic important to the poultry industry; and 2) land application of waste from the poultry production. PPPSRU can be reached at 479-575-4202 or on the world wide web at www.uark.edu/~usdaars/.

South Central Agricultural Research laboratory (SCARL)/ARS/USDA conducts multi-disciplinary research for developing technologies to establish and sustain production and post harvest quality of alternative crops such as vegetables, small fruits, and kenaf. The Laboratory is co-located with the Oklahoma State University's Wes Watkins Research and Extension Center in Lane, OK. SCARL can be reached by phone at 580-889-7395 or on the world wide web at www.lane-ag.org.

Shirley Community Development Corporation (SCDC) is a community-based organization formed to plan and initiate short- and long-term development programs for Shirley, AR and the surrounding communities. These programs focus on economic development, educational enhancement, youth job training, and service projects that improve and strengthen the community. SCDC is involved in projects that research and demonstrate the skills and techniques needed for production and marketing of specialty agricultural crops. The present focus is on log-grown Shiitake mushrooms. SCDC operates the Shiitake Mushroom Center as a training center. Recent additions include on-site production of garden bricks and stepping stones, raised bed herbal plots, twin wall polycarbonate greenhouse, and compost demonstration project. SCDC can be reached by phone at (501) 723-4443 or on the web at http://www.shiitakecenter.com/index.html.

The Kerr Center for Sustainable Agriculture in Poteau, OK offers leadership and educational programs to those interested in making farming and ranching environmentally friendly, socially equitable, and economically viable. The Kerr Center can be reached by phone at 918-647-9123, by email at mailbox@kerrcenter.com or on the web at www.kerrcenter.com.

ATTRA, Appropriate Technology Transfer for Rural Areas, is the national sustainable agriculture information center. ATTRA provides technical assistance to farmers, Extension agents, market gardeners, agricultural researchers, and other ag professionals. ATTRA is located in Fayetteville, AR.

ATTRA staff members prefer to receive requests for information at 800-346-9140. ATTRA maintains a web site at www.attra.org

The Grassroots Grazing Group (GGG) is a network of livestock producers mainly from northwest Arkansas but includes producers from many other states including Virginia, Missouri, and Oklahoma. GGG maintains a electronic mailing list on which members routinely share information and opinions regarding various topics on forage management and livestock production. Members meet monthly, usually at a member's farm, to see and discuss information related to grazing practices. Individuals interested in joining the GGG should contact Ann Wells at annw@ncatark.uark.edu.

The Center for Advancement of American Black Walnut is a non-profit organization promoting the planting of an improved variety of eastern black walnut for nut production. For more information contact the Center's Director, Jim Jones, at P. O. Box 600, Stockton, MO 65785, 417-276-6010 (voice), 417-276-6011 (fax), or jonesctr@hotmail.com (e-mail).

Information regarding the ***Arkansas Cooperative Extension Service and the Division of Agriculture*** can be found on the internet at the following web site: www.uaex.edu.

Attention

Are you interested in a person to speak at a meeting of your civic or agricultural group? If so, please contact David Brauer at 479-675-3834 to see if we can match your interests/needs to the expertise of the Center's staff.

Upcoming Events

- September 20, 2003 - 2nd Sheep Field Day. Details to follow in the future

Working together works.

Nothing big ever came from being small.

There are no secrets to success: Don't waste time looking for them. Success is the result of perfection, hard work, learning from failure, loyalty to those for whom you work, and persistence.

General Colin Powell

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